

UNITED STATES PATENT AND TRADEMARK OFFICE  
**CERTIFICATE OF CORRECTION**

PATENT NO. : 7,231,054 B1  
APPLICATION NO. : 09/806193  
DATED : June 12, 2007  
INVENTOR(S) : Jot et al.

Page 1 of 5

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

On sheet 11 of 13, in Fig. 9, delete “lousspeaker” and insert -- loudspeaker --, therefor.

On sheet 12 of 13, in Fig. 10, delete “directionnal” and insert -- directional --, therefor.

On Sheet 13 of 13, in Fig. 11, delete “directionnal” and insert -- directional --, therefor.

In column 1, lines 29–63, delete “An alternative approach, described in [Gerzon85], consists of producing a ‘B-Format’ multi-channel signal and reproducing this signal over loudspeakers via an ‘Ambisonic’ decoder, as illustrated in FIG. 2. Instead of discrete panning functions, the B Format uses real-valued spherical harmonics. The zero-order spherical harmonic function is named W, while the three first-order harmonics are denoted X, Y, and Z. These functions are defined as follows:

$$W(\sigma, \Phi)=1$$

$$X(\sigma, \Phi)=\cos(\Phi)\cos(\sigma)$$

$$Y(\sigma, \Phi)=\cos(\Phi)\sin(\sigma)$$

$$Z(\sigma, \Phi)=\sin(\Phi)$$

where  $\sigma$  and  $\Phi$  denote respectively the azimuth and elevation angles of the sound source with respect to the listener, expressed in radians. An advantage of this technique over the discrete panning method is that B Format encoding does not require knowledge of the loudspeaker layout, which is taken into account in the design of the decoder. A second advantage is that a real-world B-Format recording can be produced with practical microphone technology, known as the ‘Soundfield Microphone’ [Farrah79]. As illustrated in FIG. 2, this allows for combining microphone-encoded sounds with electronically encoded sounds to produce a single B-format recording. First-order Ambisonic decoders do not reconstruct the acoustic pressure information at the ears of the listener except at low frequencies (below about 700 Hz). As described e.g. in [Bamford95], the frequency range can be extended by increasing the order of spherical harmonics, but only at the expense of a higher number of encoding channels and loudspeakers.” and insert the same on Col. 1, Line 30, below “mixing stage.” as a new paragraph.

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It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In column 3, line 26, after "listener" insert -- , --.

In column 4, line 9, after "which" insert -- : --.

In column 4, line 22 (Approx.), after "playback" insert -- . --.

In column 4, line 32 (Approx.), delete "Discrete" and insert -- discrete --, therefor.

In column 4, line 38 (Approx.), after "playback" insert -- . --.

In column 4, line 54 (Approx.), after "playback over" delete "over". (Second occurrence)

In column 5, line 23 (Approx.), delete " $L(\sigma_p, \phi_p, f) = T_L(\sigma_p, \phi_p, f)L(\sigma_p, \phi_p, f)$ , " and  
insert --  $L(\sigma_p, \phi_p, f) = T_L(\sigma_p, \phi_p, f)L(\sigma_p, \phi_p, f)$ , --, therefor.

In column 7, line 10, delete " $H(f) = \exp(j\Phi(f))H_{min}(f)$ " and  
insert --  $H(f) = \exp(j\psi(f))H_{min}(f)$  --, therefor.

In column 7, line 12 (Approx.), delete " $\Phi(f)$ ," and insert --  $\psi(f)$ , --, therefor.

In column 7, line 14 (Approx.), delete " $\Phi(f)$ ," and insert --  $\psi(f)$ , --, therefor.

In column 7, line 17 (Approx.), delete " $\Phi_R$ " and insert --  $\psi_R$  --, therefor.

In column 7, line 17 (Approx.), delete " $\Phi_L$ " and insert --  $\psi_L$  --, therefor.

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In column 7, lines 20–23 (Approx.), delete “The interaural time delay difference, ITD ( $\sigma_p, \phi_p$ ), can be defined, for each direction ( $\sigma_p, \phi_p$ ), by a linear approximation of the interaural excess-phase difference:

$\Phi_R(\sigma, \phi, f) - \Phi_L(\sigma, \phi, f) \approx 2\pi f ITD(\sigma, \phi)$  .. and insert the same on Col. 7, Line 21 (Approx.), below “ $(\sigma_p, \phi_p, f)$  ..” as a new paragraph.

In column 7, line 23 (Approx.), delete “ $\Phi_R(\sigma, \phi, f) - \Phi_L(\sigma, \phi, f) \approx 2\pi f ITD(\sigma, \phi)$  ..” and insert --  $\psi_R(\theta, \varphi, f) - \psi_L(\theta, \varphi, f) \approx 2\pi f ITD(\theta, \varphi)$  --, therefor.

In column 7, line 39 (Approx.), delete “ $ITD(\sigma, \phi) = 2r/c \cos(\phi) \sin(\sigma)$  ..” and insert --  $ITD(\theta, \varphi) = 2r/c \cos(\varphi) \sin(\theta)$  --, therefor.

In column 7, line 57 (Approx.), delete “ $\Phi_{R,L}(\sigma, \phi, f) - \Phi_L(\sigma, \phi, f)$  ..” and insert --  $\psi_R(\theta, \varphi, f) - \psi_L(\theta, \varphi, f)$  --, therefor.

In column 7, line 58 (Approx.), delete “ $\Phi(\sigma, \phi, f)$  ..” and insert --  $\psi(\theta, \varphi, f)$  --, therefor.

In column 7, line 59 (Approx.), delete “ $\Phi_R(\sigma, \phi, f) - \Phi_L(\sigma, \phi, f) - \Phi(\sigma, \phi, f)$  ..” and insert --  $\psi_R(\theta, \varphi, f) - \psi_L(\theta, \varphi, f) \approx \psi(\theta, \varphi, f)$  --, therefor.

In column 8, line 2 (Approx.), delete “ $\Phi_R(f) - \Phi_L(f) - \Phi_R(f) - \Phi_L(f) - \Phi(\sigma, \phi, f)$  ..” and insert --  $\psi_R(f) - \psi_L(f) = \psi_R(f) - \psi_L(f) - \psi(\theta, \varphi, f)$  --, therefor.

In column 8, line 5 (Approx.), delete “ $\sigma_p, f$  and  $R(\sigma_p, \sigma_p, f)$  ..” and insert --  $\psi_p, f$  and  $R(\theta_p, \varphi_p, f)$  --, therefor.

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It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In column 8, line 30 (Approx.), after "recording" insert -- . --.

In column 9, line 55 (Approx.), delete "ortogonal," and insert -- orthogonal, --, therefor.

In column 9, line 64 (Approx.), delete " $\langle g_i, g_k \rangle = 1/(4\pi) \int_0^\pi \int_0^\pi g_i(\sigma, \phi) g_k(\sigma, \phi) \cos(\phi) d\sigma d\phi$ " and insert --  $\langle g_i, g_k \rangle = 1/(4\pi) \int_0^\pi \int_0^\pi g_i(\theta, \varphi) g_k(\theta, \varphi) \cos(\varphi) d\theta d\varphi$  --, therefor.

In column 12, line 21, delete " $g_i(\sigma, \phi)$ " and insert --  $g_i(\theta, \varphi)$  --, therefor.

In column 12, line 25, delete " $\sigma, \Phi$ " and insert --  $\theta, \varphi$  --, therefor.

In column 12, lines 25–26, delete " $\sigma, \Phi$ " and insert --  $\theta, \varphi$  --, therefor.

In column 12, line 40, delete " $L_{ij}$ " and insert --  $L_{ij}$  --, therefor.

In column 12, line 41, delete " $L_{ij} = L(\sigma_i, \phi_i, \beta) / L(\sigma_j, \phi_j, \beta)$ " and insert --  $L_{ij} = L(\theta_i, \varphi_i, \beta) / L(\theta_j, \varphi_j, \beta)$  --, therefor.

In column 12, line 42 (Approx.), delete " $L_{ij}$ " and insert --  $L_{ij}$  --, therefor.

In column 12, line 46 (Approx.), delete " $L_{ij} = \exp(2\pi j f[(\sigma_i, \phi_i) - (\sigma_j, \phi_j)]) L(\sigma_i, \phi_i, \beta) / L(\sigma_j, \phi_j, \beta)$ " and insert --  $L_{ij} = \exp(2\pi j f[(\theta_i, \varphi_i) - (\theta_j, \varphi_j)]) L(\theta_i, \varphi_i, \beta) / L(\theta_j, \varphi_j, \beta)$  --, therefor.

In column 14, line 11, in Claim 7, delete "of set" and insert -- set of --, therefor.

In column 14, line 36, in Claim 8, delete " $g_i(\theta_p, \Phi_p)$ " and insert --  $g_i(\theta_p, \Phi_p)$  --, therefor.

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In column 14, line 59, in Claim 12, delete “ $g_i(\theta_p, \Phi_p, f)$ ” and insert --  $g_i(\theta_p, \phi_p)$  --, therefor.

In column 14, line 65, in Claim 14, after “ $\Delta L$ ” insert -- , --.

In column 15, line 12, in Claim 18, after “ $Y_R$ ,” insert -- and --.

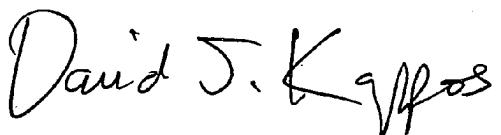
In column 15, line 15, in Claim 18, delete “left-and” and insert -- left- and --, therefor.

In column 16, line 3, in Claim 21, after “including” insert -- performing --.

In column 16, line 21 (Approx.), in Claim 26, delete “claims 22 or 23” and insert -- claim 22 --, therefor.

Signed and Sealed this

Twenty-second Day of December, 2009



David J. Kappos  
*Director of the United States Patent and Trademark Office*